(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 795 382 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
17.09.1997 Bulletin 1997/38

(51) Int Cl.6: B26D 5/00, B31B 1/16,
B26D 7/26

(21) Application number: 97301107.5

(22) Date of filing: 20.02.1997

(84) Designated Contracting States:
CH DE FR GB IT LI NL

(30) Priority: 13.03.1996 JP 55890/96

(71) Applicant: MITSUBISHI HEAVY INDUSTRIES, LTD.
Tokyo 100 (JP)

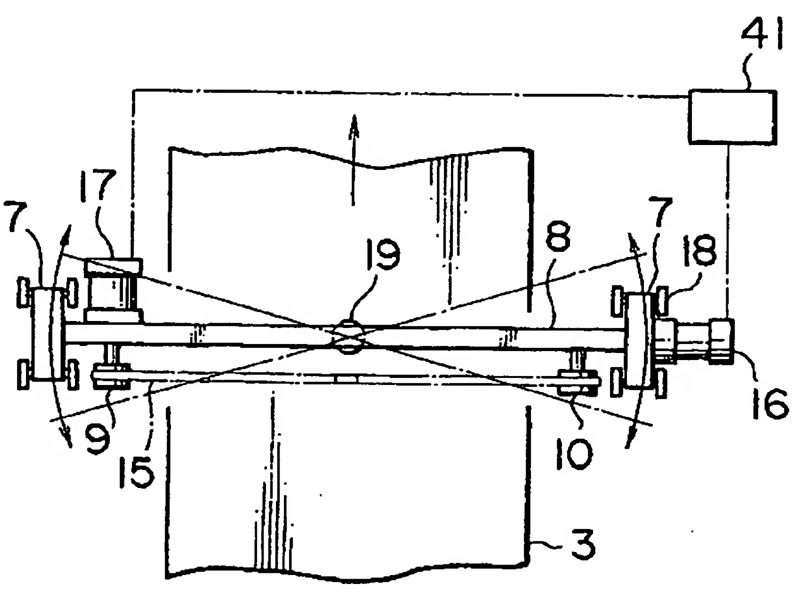
(72) Inventors:
- Seki, Yukuharu, c/o Mitsubishi Heavy Ind. Ltd.
Mihara-shi, Hiroshima-ken (JP)
- Kato, Toshihide, c/o Mitsubishi Heavy Ind. Ltd.
Mihara-shi, Hiroshima-ken (JP)

(74) Representative: Goddard, David John et al
Harrison Goddard Foote,
Vine House,
22 Hollins Lane
Marple Bridge, Stockport SK6 5BB (GB)

(54) Order change apparatus and cutting apparatus for a corrugating machine

(57) The present invention provides an order change apparatus for a corrugating machine, in which an undirectional cutting device is installed on a frame rotatably installed around a support shaft provided substantially on the machine centerline so as to run on the frame, and the frame can be moved to a preset angle with respect to the web running direction, by which the order change region is shortened in high-speed order changing even with a limited cutting capacity of cutting device.

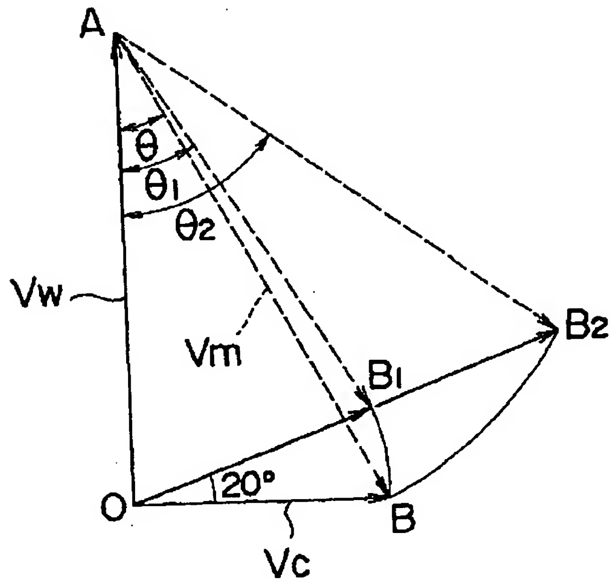
FIG. 1



Printed by Jouve, 75001 PARIS (FR)

(Cont. next page)

FIG. 3a



Description

FIELD OF THE INVENTION AND RELATED ART STATEMENT

The present invention relates to an order change apparatus for a corrugating machine for manufacturing corrugated fiberboard and a cutting apparatus used for the order change apparatus.

FIG. 8 shows an arrangement of the conventional corrugating machine on the downstream side of a rotary shear, and FIGS. 9 to 12 show conventional order change methods (methods for making transverse cuts).

In FIG. 8, reference numeral 2 denotes a rotary shear. The rotary shear 2 is provided with a knife cylinder 25 and an anvil cylinder 26. The knife cylinder 25 has a knife 24 which is longer than the overall width of a corrugated fiberboard web 3, and the anvil cylinder 26 has an anvil cover 27 which is made of an elastic material such as rubber. The rotary shear 2 is configured so as to cut the corrugated fiberboard web 3 in the width direction by holding the web 3 between the knife 24 and the anvil cover 27 and pressing it by them.

In the rotary shear 2, the paper joint portion of the corrugated fiberboard 3 and the defective portion thereof produced by other causes are cut off into a rectangular sheet of a given length by continuously rotating the rotary shear two or more turns, and the cut-off sheet is discharged downward by a defect removing device 42.

Reference numerals 1a and 1b denote slitter scorers. The slitter scorer 1a, 1b is provided with a marking roll 28a, 28b and a slitter knife 29a, 29b. The marking roll 28a, 28b makes fold lines for corrugated fiberboard box, and the slitter knife 29a, 29b slits the corrugated fiberboard web 3 in the flow direction with a predetermined width.

Reference numeral 22 denotes a cutoff. The cutoff 22 cuts a slit web 5, which has been slit in the flow direction by the slitter scorers 1a and 1b, in the direction perpendicular to the flow with a predetermined length. Reference numerals 30a and 30b denote trim ducts. The trim duct 30a, 30b attracts and removes trims 23a and 23b (see FIG. 9).

The corrugating machine produces sheets corresponding to various box sizes. In order to produce such sheets, as shown in FIG. 9, slitting in the flow direction and marking (marking line is not shown) of the corrugated fiberboard web 3 are performed by the slitter scorers 1a and 1b, and cutting in the direction perpendicular to the flow is performed with cut lengths Ld and Lt by the top and down cutoffs 22a and 22b, by which a corrugated fiberboard sheet of a predetermined size is produced. The solid lines drawn in the lengthwise direction of the slit web 5 in FIGS. 9 to 12 and 16 indicate cut lines.

At this time, the produced corrugated fiberboard sheets have only one size at one time. In the figure, two cutoffs 22a and 22b are installed to produce the sheets of two sizes. In FIGS. 9 and 10 (the same in the following figures), the slit web 5 cut by the down cutoff 22b is indicated by hatch rising at right, and the slit web 5 cut by the top cutoff 22a is indicated by hatch rising at left. In FIG. 9, C indicates the rotary shear cut line, and arrow W indicates the web advance direction.

Order change means that the predetermined box size is changed. As shown in FIG. 9, in the new and old orders ND and OD before and after the order change region D, the slitting width by the slitter scorers 1a and 1b and the cutting length by the cutoff 22 differ.

In order to change the slitting width by the slitter scorers 1a and 1b, a method is used in which if the old order OD is being slit by a slitter scorer 1a, the slitting and marking positions of the new order ND are set by the slitter knife 29b and the marking roll 28b of the slitter scorer 1b during the production of the old order OD, and the operating unit is changed over from the slitter scorer 1a to the slitter scorer 1b without stopping the operation at the time of order change.

The change of the cutting length of the cutoffs 22a and 22b is made by instantaneously changing over the electrical signals controlling the rotational speed of the knife.

When the order change is made, if only the slitting width is changed as shown in FIG. 9, the slit web 5 is torn in the order change region D before reaching the cutoff 22.

For this reason, conventionally, the corrugated fiberboard web 3 is cut over the overall width in the direction perpendicular to the flow by the rotary shear 2 on the upstream side as shown by the dash-and-dot line in FIG. 9 assuming the order change region D in advance, and the order change region D is removed as a defective sheet by the defect removing device 42. Thereby, the slit web 5 going to the top cutoff 22a and the slit web 5 going to the down cutoff 22b of the new order ND are separated completely. In this case, the control for making the cut portion by the rotary shear 2 coincide with the cut portion by the slitter scorers and cutoff on the downstream side is achieved by the synchronous control of the entire system.

FIG. 10 shows an improvement of FIG. 9. In this method, together with the improvement in change-over accuracy of slitter scorers 1a and 1b, although the order change region D of a predetermined length is provided in FIG. 9, in order to decrease this length to the utmost (because the change region becomes defective paper), the slitter slit portions of the new and old orders are lapped, and this lap portion D' is separated by the rotary shear 2.

However, in the methods shown in FIGS. 9 and 10, the leading end of the new order ND and the tail end of the old order OD cut by the rotary shear 2 become free by separation. Therefore, the leading end of the new order ND collides with a transfer guide member during the subsequent travel and jams up, or moves in a zigzag direction, resulting

in a poor cutting accuracy. Also, the remaining web of the old order OD between the rotary shear 2 and the cutoff 22 produces a poor cutting accuracy by zigzag movement etc.

To solve the above problems, a method has been proposed in which as shown in FIGS. 11 and 12, only the portion between the slitter lines M, which are the separation lines of the top and down cutoffs 22a and 22b, is cut by a cut line NO. An example shown in FIG. 11 is a case where the shift of M lines of the new and old orders is relatively small. In this case, the webs 5(A) and 5(C) of the down side and the webs 5(B) and 5(D), 5(E) of the top side are joined together before and after the order change, so that the order change can be performed without separating the web. In the figures, K denotes an order change point.

In the above-described method, however, when the M lines shift greatly before and after the order change and the slitting width is relatively small as shown in FIG. 12, the tail end of the slit web 5c and the leading end of the slit web 5f are separated completely, becoming free, so that the trouble caused by separation as described above occurs.

Thus, a method has been proposed in which a special cutting apparatus 4 is installed as shown in FIG. 13, and an order change region D as shown in FIG. 16 is provided so that the webs flow continuously on both the top and down side by separating only the boundary of the top and down sides (Unexamined Japanese Patent Publication No. 6-210772 and U.S. Patent No. 5496431). FIGS. 14 and 15 show the construction of the cutting apparatus 4 used in this method.

In FIGS. 14 and 15, a cutting nozzle 39 of water jet etc. runs across the corrugated fiberboard web 3 by means of an endless chain 15, by which N portion in FIG. 16 is cut.

In the above-described apparatus, a frame 7 is inclined around a frame 6 to make the length of order change region adjustable. The order change region D in FIG. 16 is cut and removed as a defective portion by synchronously operating the cutoff on the downstream side.

However, in this method, a technique, in which the capacity of an undirectional cutting device such as water jet 39 and laser cutter, that is, a cutting device which can be moved in any direction with respect to the flow of fluid or light, is brought out to the utmost, is not considered.

OBJECT AND SUMMARY OF THE INVENTION

In recent years, the speed of order change on a corrugating machine has increased more and more. The order change is now made at a sheet speed of about 350 m/min, and this speed will further be increased in the future.

On the other hand, the capacity of, for example, the aforementioned water jet 39 for cutting a corrugated fiberboard sheet is now limited to about 400 m/min depending on various conditions. Under this condition, when the corrugated fiberboard web 3 of 1 m wide is cut by merely moving the water jet cutting nozzle 39 laterally with respect to the web 3, the order change region D of about 1.8 m is required.

As described above, the order change region D is thrown away as a defective sheet because it cannot be used as the final product of corrugated fiberboard sheet. Therefore, the order change region D of 1.8 m is a length resulting in the decrease in production efficiency, so that the shortening of the order change region D has been demanded strongly.

An object of the present invention is to provide an order change apparatus and a cutting apparatus which can decrease the length of the order change region to the utmost with the cutting capacity of the present undirectional cutting device, can provide a cut shape having less jamming-up, and further have a simplified function and a compact size.

The present invention was made to solve the above problem, and provides an order change apparatus for a corrugating machine having a slitter scorer for slit cutting a corrugated fiberboard web into a plurality of sheets in parallel to the running direction and a plurality of cutoffs which are disposed on the downstream side of the slitter scorer to cut the introduced web in the direction perpendicular to the web running direction to branch a predetermined number of sheets, in which when order change is made, a portion which is not slit cut is provided between the leading end of a new order web and the tail end of an old order web, and the vicinity of tail end at the boundary slit line of the old order and the vicinity of leading end at the boundary slit line of the new order, which are made to branch on the downstream side of said slitter scorer, are separated, the order change apparatus comprising a frame rotatably installed around a support shaft provided substantially on the machine centerline, undirectional cutting means installed on the frame, cutter running means for running the cutting means on the frame, and moving means for moving the frame to a preset angle with respect to the web running direction.

In the above-described apparatus, the undirectional cutting means such as a water jet and a laser cutter is run at a given angle to a reference line at right angles to the web advance direction.

This running direction at an angle is a direction such that the velocity component of the cutting means in the flow direction agrees with the flow direction of sheet (web). By this operation, the relative velocity between the cutting means and the web can be decreased, and the capacity of the cutting means can be brought out to the utmost. Thereby, the length of the order change region can be reduced.

The order change region is cut and removed as a defective portion by synchronously operating the cutoff on the downstream side.

Usually, the position of boundary slit of web is in the vicinity of machine center. However, since the frame is configured so as to be turned substantially around the machine center as described above, the swinging amount of cutting means when the frame is turned is small, so that the correction amount of control position is small. Also, when the frame is turned in both directions around the center, the installation space required by the turning is about a half of the space for the conventional apparatus (in which the frame is turned in one direction).

Preferably, the angle of the boundary slit line with respect to the web running direction is in the range of 30° to 60°.

Generally, if the web end is brought close to the right angle with respect to the flow direction to shorten the order change region, the end on the non-connected side runs unstably, resulting in easy occurrence of jamming-up. According to the present invention, however, since the boundary slit line has an angle of 30° to 60° with respect to the web running direction, the occurrence of jamming-up can be prevented by the relief effect by this inclination angle.

Also, the cutting apparatus for the corrugating machine is configured as described below. The cutting apparatus comprises two undirectional cutting means installed on a frame rotatably installed around a support shaft, chain track running means such as an endless chain for running the cutting means over the overall width of the web on the frame, and moving means for moving the frame to a preset angle with respect to the web running direction, the chain track running means are arranged oppositely so as to run in parallel to each other and in the reverse direction at least in the range of cutting, and the cutting means are provided on the opposite side of the running means.

Further, the cutting apparatus has the rotation center of the frame substantially on the machine centerline, and an order change apparatus for a corrugating machine, in which defect removing means is added to the cutting apparatus, and which comprises the cutting apparatus and trim cutting means for making cut at a trim portion only.

According to the above-described cutting apparatus, since undirectional cutting means are used, the cutting direction of the cutting apparatus can be set freely, and the overall width can be cut with a short length, so that the apparatus can have a function of rotary shear. Thereupon, the rotary shear can be omitted, and it is enough to provide a cutting apparatus having a trim cutting function only, so that the decrease in product cost can be achieved.

The present invention is configured as described above. According to the present invention, the undirectional cutting means are installed on the rotatable frame so as to run on the frame, the frame is moved to a preset angle with respect to the web running direction, and the direction of velocity component of the cutting means in the sheet advance direction agrees with the web advance direction. Therefore, the order change region can be shortened in high-speed order changing even with a limited cutting capacity of cutting means, loss sheet (defective sheet) can be decreased, the productivity can be improved, the installation space of machine can be reduced, and the manufacturing cost of machine can be lowered.

Also, since the length of the order change region and cut angle can be adjusted freely, stable operation without jamming-up can be performed by controlling the cutting speed regardless of the order change speed and cutting width.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view (view of arrow A in FIG. 2) of a cutting apparatus in accordance with a first embodiment of the present invention;
FIG. 2 is a front view of the apparatus shown in FIG. 1;
FIG. 3 is a view for illustrating a method of making cut in the above first embodiment;
FIG. 4 is a front view of a cutting apparatus in accordance with a second embodiment of the present invention;
FIG. 5 is a view for illustrating a method of making cut in the above first and second embodiment;
FIG. 6 is a view for comparing the defect removing function of a rotary shear;
FIG. 7 is an arrangement plan of a corrugating machine in accordance with a third embodiment of the present invention;
FIG. 8 is an arrangement plan of a conventional corrugating machine;
FIG. 9 is a view (No. 1) for illustrating a conventional method of making cut;
FIG. 10 is a view (No. 2) for illustrating a conventional method of making cut;
FIG. 11 is a view for illustrating another method of making cut;
FIG. 12 is a view for illustrating a problem of the conventional method of making cut;
FIG. 13 is an arrangement plan of another conventional corrugating machine;
FIG. 14 is a plan view of another conventional cutting apparatus;
FIG. 15 is a front view of the apparatus shown in FIG. 14; and
FIG. 16 is a view for illustrating a method of making cut by using another conventional cutting apparatus.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Embodiments of the present invention will be described in detail with reference to the drawings.

FIG. 1 is a plan view (view of arrow A in FIG. 2) of a cutting apparatus in accordance with a first embodiment of the present invention, and FIG. 2 is a front view thereof.

In FIGS. 1 and 2, reference numeral 7 denotes a pair of frames slidably supported on track faces 20. The right and left frames 7, 7 are connected to each other by an upper beam 8 and a lower beam 12. At the lower end of the frame 7 is installed running wheels 18 which are rotated by a motor 16.

At the center of the lower beam 12 is provided a support shaft 19, which is rotatably supported by a bearing 11 on the ground.

Therefore, when the motor 16 rotates, the frames 7 on both sides and beams 8 and 12 are turned as a unit around the support shaft 19.

The upper beam 8 is provided with sprockets 9 and 10, and an endless chain 15 is set over the sprockets 9 and 10. The endless chain 15 is equipped with a cutting nozzle 39 for a water jet cutting device.

One driving sprocket 9 is directly connected to a motor 17, and the other driven sprocket 10 can be rotated freely. Therefore, when the motor 17 is rotated, the cutting nozzle 39 runs along the upper beam 8.

Reference numeral 41 denotes a computing unit, to which various data such as the web speed at the time of order change, the start and end positions of cutting by the cutting nozzle 39, the order change region setting length, and the like are inputted. The computing unit 41 computes the optimum running angle and running speed of the cutting nozzle 39, and gives driving instructions to the motors 16 and 17. In FIG. 2, reference numeral 21 denotes an angle detecting means for detecting the turning angle of the upper beam 8, and 40 denotes a bearer installed below the cutting nozzle 39.

Next, the operation of the cutting apparatus shown in FIGS. 1 and 2 will be described with the embodiment. FIG. 3(a) shows a method of making cut when a web is cut by the cutting nozzle 39 using the water jet, and FIG. 3(b) collectively shows the order change region lengths under various cutting conditions described below.

The cutting particulars of the cutting apparatus in this embodiment are as follows:

Web speed at the time of order change	350 m/min
Maximum cutting speed of water jet	400 m/min
Cutting width (measured at right angles to the web advance direction)	1 m

(1) First, as a first example, explanation is given on a case where the cutting nozzle 39 is moved at right angles to the advance direction of the corrugated fiberboard web 3 to the right in FIG. 1. In FIG. 3, the origin is taken as O, the velocity vector of web is taken upward as OA, and the running velocity vector of the cutting nozzle 39 is taken to the right as OB. Then, AB is the relative velocity between the cutting nozzle 39 and the web. This relative velocity should not exceed the aforementioned maximum cutting speed of 400 m. The traveling speed of the cutting nozzle 39 is limited by this condition, and becomes 193 m/min by the calculation based on the above condition. In FIG. 3(a), Vw indicates the web velocity of 350 m/min, Vc the traveling velocity of cutting device, and Vm the relative velocity of 400 m/min of the cutting device with respect to the slit web.

The angle θ of cut line in this case is 29°. If a web width of 1 m is cut, the length of the order change region is 1.8 m as shown in FIG 3(b).

(2) Next, as a second example, explanation is given on a case where the traveling direction of the cutting nozzle 39 is inclined 20° with respect to the advance direction of web and the traveling speed of the cutting nozzle 39 is still 193 m/min. In this case, the velocity vector of the cutting nozzle 39 can be drawn as OB_1 in FIG. 3(a), and AB_1 is the relative velocity between the cutting nozzle 39 and the web. The calculation of these numerical values gives the relative velocity (AB_1) of 337 m/min and the angle θ_1 of cut line of 32.7°. Based on these values, the length of the order change region for cutting width of 1 m is 1.6 m as shown in FIG. 3(b). Thus, by inclining the traveling direction of the cutting nozzle 39 by a predetermined angle with respect to the advance direction of the web 3, the length of the order change region can be decreased.

(3) The relative velocity in the case of (2) is 337 m/min, which is lower than the maximum cutting speed of the cutting apparatus of 400 m/min. This means that the traveling speed of the cutting nozzle 39 can be increased further in the case of (2). To determine the quantity of speed increase, in FIG. 3(a), the intersection B_2 of the extension of OB_1 and the circle drawn with a radius AB equivalent to the maximum cutting speed of 400 m/min around A is determined. Then, OB_2 is equivalent to the traveling speed such that the relative velocity between the cutting nozzle 39 and the web 3 is the maximum value of 400 m/min, and θ_2 is the angle of cut line of the web 3.

The calculation of these values gives the traveling speed of the cutting nozzle 39 of 347 m/min and the inclination angle θ_2 of 54.7°, and the length of the order change region in this case is 0.7 m (see FIG. 3(b)).

Thus, by inclining the traveling direction to the advance direction of web as in the case of (2), the length of the order change region can be decreased. Further, by controlling the traveling speed of the cutting nozzle 39, the length of the order change region can be reduced significantly by the improvement in operating method etc. even if the capacity of the cutting apparatus is limited to a value lower than a given value.

(4) In the examples described in the items (2) and (3), the traveling angle θ of the cutting nozzle 39 was set at 20° at the first. However, in the actual operation of the corrugating machine, the length of the order change region must be controlled so as to be a given allowable value. In this case, the traveling speed and the traveling angle θ of the cutting nozzle can be calculated by determining the angle of cut line from the cutting width and the allowable length of the order change region and by making drawing as in FIG. 3(a).

The reason why the traveling direction of the cutting nozzle 39 can be inclined to both directions of up right and down right in FIG. 1 is that cutting must be done so that the direction of cut line is not only down right direction as shown in FIG. 3 but also up right direction depending on the size of sheet (web) before and after the order change.

In order to cut a sheet so that the cut line of the sheet 3 is in up right direction, the frame 7 is inclined so that the travel line of the cutting nozzle 39 is in the down right direction in FIG. 1, and the cutting nozzle is run from left to right.

Although in the conventional example shown in FIGS. 14 and 15, the frame 6 on one side is the center of rotation, in this embodiment, the cutting apparatus is configured so that the frames 7 are rotated around the center of machine (also, the center of the corrugated fiberboard web 3). Therefore, as shown in FIGS. 6(a) and 6(b), if the inclination of $\alpha°$ around the rotation axis O_1 requires a space of a total of 2 m, 1 m in each direction, in the conventional apparatus, it requires 1 m, a half of the above value, in this embodiment in which rotation is made around the machine center (rotation axis O_1). Thereby, the length for installing the corrugating machine is shortened.

Usually, the cut line M is most frequently in the vicinity of the machine center. Therefore, if the machine center is the rotation center of the frame and the inclination of the frames 7 changes, the position shift of the cutting nozzle 39 in the vicinity of the center in the flow direction becomes small, so that the cutting start position of the web 3 in the flow direction becomes more accurate.

It is natural that in order to decrease the length of the order change region, the angle θ of the cut line should be brought close to the right angle to the web flow direction. On the other hand, as shown in FIG. 5(a), the corner indicated by Z swings by the self weight or the air flow in running, becoming unstable, so that jamming-up occurs easily. If the angle θ is small, the running stability increases, but the length of the order change region increases, resulting in the increase in loss. Therefore, the angle of the cut line should preferably be approximately 30° to 60° as shown in FIG. 5(b).

FIG. 4 is a front view of a corrugating machine in accordance with a second embodiment of the present invention. The construction of the frame in this embodiment is the same as that in the first embodiment shown in FIGS. 1 and 2.

In FIG. 4, the endless chain 15 is set in the range over the width of the corrugated fiberboard web 3 so that the opposite portions 15a and 15b are formed in parallel so as to run in the direction opposite to each other. Each of the opposite portions of the endless chain 15 is provided with a cutting nozzle 39a, 39b.

In this arrangement, when one cutting nozzle 39a travels from left to right while cutting, the other cutting nozzle 39b reversely travels from right to left, and when one cutting nozzle 39a reaches the right end, the other cutting nozzle 39b comes to the left end, which is the original position of the cutting nozzle 39a. Next, when the endless chain 15 is run in the opposite direction, the other cutting nozzle 39b travels from left to right. Thus, by successively changing the cutting nozzles 39a and 39b blowing off a jet, cutting can successively be performed repeatedly in the same direction without the time taken for the nozzle to be returned to the original position unlike the case where one cutting nozzle is provided.

By such a configuration, the defective sheet, which is separated by plural continuous rotations of rotary shear in the conventional method, can be cut short in the flow direction even at a high speed.

FIG. 7 is an arrangement plan of an order change apparatus for a corrugating machine in accordance with a third embodiment of the present invention. In this embodiment, a defect removing device 42 and a cutting apparatus 43 for cutting trim only are added to the cutting apparatus 4 in the above-described second embodiment.

In the conventional rotary shear, the overall width of corrugated fiberboard web 3 must be cut to remove a defective sheet. Therefore, a considerably thick member must be used for the knife cylinder 25 and the anvil cylinder 26 to provide high rigidity.

However, by configuring as in the first and second embodiments, the web can be cut sufficiently short by the unidirectional cutting apparatus, and substantially at right angles by the cutting apparatus 4 of the first embodiment so as to bring out the capacity of water jet cutter to the utmost. Therefore, the cutting of the overall width, which has conventionally been done by the rotary shear 2, can be done by the apparatus of the second embodiment.

Accordingly, at the position corresponding to the conventional rotary shear 2, a cutting apparatus 43 for cutting trim only may be installed.

In the ordinary corrugating machine, the width of corrugated fiberboard web 3 ranges from the maximum width to about a half of the maximum width as the minimum width. Therefore, the trim cutting requires only the capacity for

cutting about a quarter of the maximum width at each side of the corrugated fiberboard web 3. Since there is no need for cutting the central portion which most strongly affects bending, the apparatus can have low rigidity as compared with the conventional apparatus, so that the apparatus can be made compact and inexpensive.

The apparatus has been described using an example of a water cutting jet having a maximum speed of 400 m/min. However, it will be appreciated by those skilled in the art that any appropriate cutting means known in the art may be employed and the operating conditions regarding relative speeds and cutting rates adjusted accordingly.

Claims

1. An order change apparatus for a corrugating machine having a slitter scorer for slit cutting a corrugated fiberboard web into a plurality of sheets in parallel to the running direction and a plurality of cutoffs which are disposed on the downstream side of said slitter scorer to cut the introduced web in the direction perpendicular to the web running direction to branch a predetermined number of sheets, in which when order change is made, a portion which is not slit cut is provided between the leading end of a new order web and the tail end of an old order web, and the vicinity of tail end at the boundary slit line of the old order and the vicinity of leading end at the boundary slit line of the new order, which are made to branch on the downstream side of said slitter scorer, are separated, said order change apparatus comprising a frame rotatably installed around a support shaft provided substantially on the machine centerline, undirectional cutting means installed on said frame, cutter running means for running said cutting means on said frame, and moving means for moving said frame to a preset angle with respect to the web running direction.

2. An order change apparatus for a corrugating machine according to claim (1), wherein the angle of said boundary slit line with respect to the web running direction is in the range of 30° to 60°.

3. A cutting apparatus for a corrugating machine for cutting the overall width of a corrugated fiberboard web, comprising a frame rotatably installed around a support shaft, at least one undirectional cutting means installed on said frame, running means for running said cutting means over the overall width of said web on said frame, and moving means for moving said frame to a preset angle with respect to the web running direction, said running means being arranged oppositely so as to run in parallel to each other and in the reverse direction at least in the range of cutting, and said cutting means being provided on the opposite side of said running means.

4. A cutting apparatus according to claim (3), wherein the rotation center of said frame is provided substantially on the machine centerline.

5. An order change apparatus for a corrugating machine, in which defect removing means is added to the cutting apparatus defined in claim (3), and which comprises said cutting apparatus and trim cutting means for making cut at a trim portion only.

6. An order change apparatus or a cutting apparatus according to either claim 1 or claim 3 wherein the axis of said support shaft is substantially perpendicular to the plane of said fibreboard web.

7. A cutting apparatus according to any one of preceding claims 3 to 6 wherein said running means is a chain track such as an endless chain.

8. A cutting apparatus according to any one of preceding claims 3 to 7 wherein there are two cutting means.

9. Apparatus according to any one preceding claim wherein said undirectional cutting means is selected from water jet cutter means or laser means.

10. Apparatus according to any one preceding claim further including: sensor means to determine angular position of said frame relative to said web; and, computer control means for controlling at least said cutter running means, said frame moving means in response to input signals relating at least to web speed and frame angular position.

FIG. 1

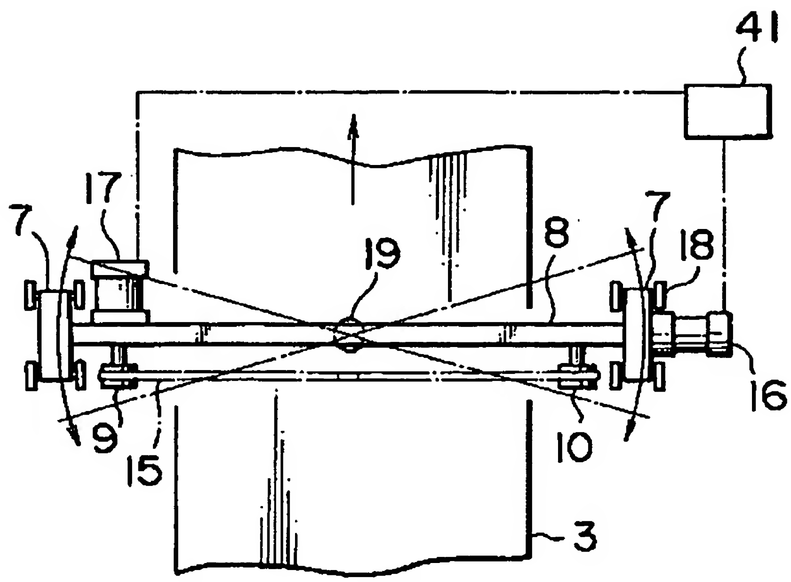


FIG. 2

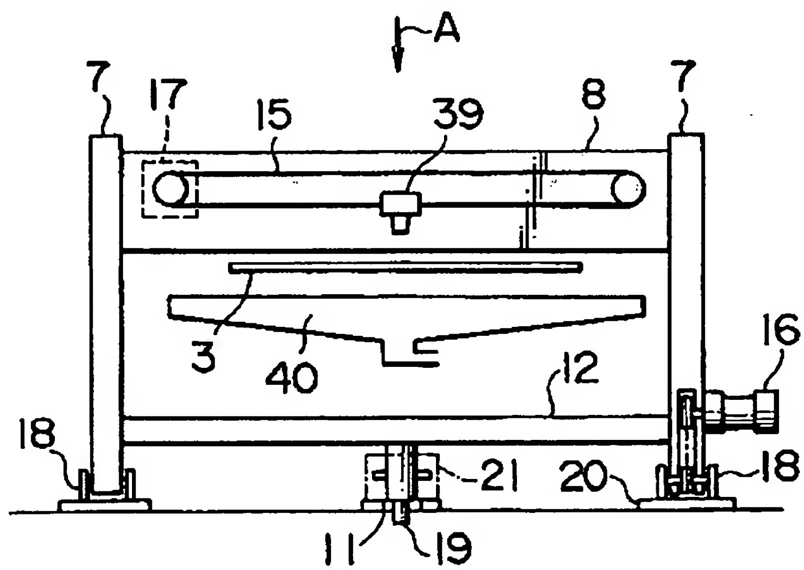


FIG. 3a

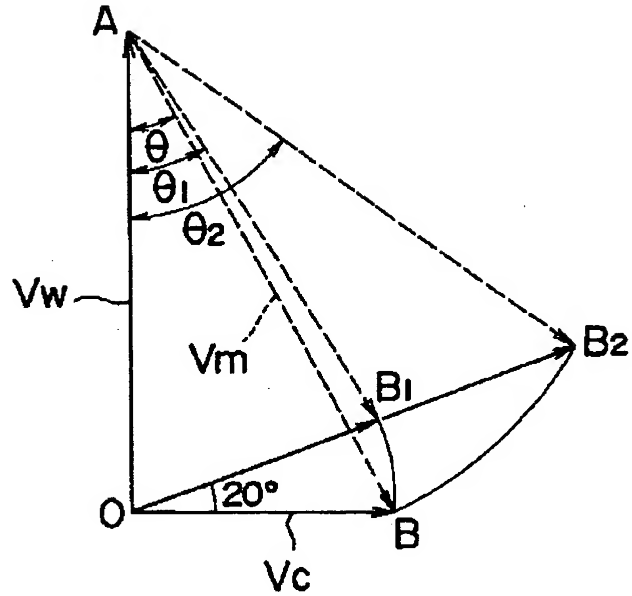


FIG. 3b

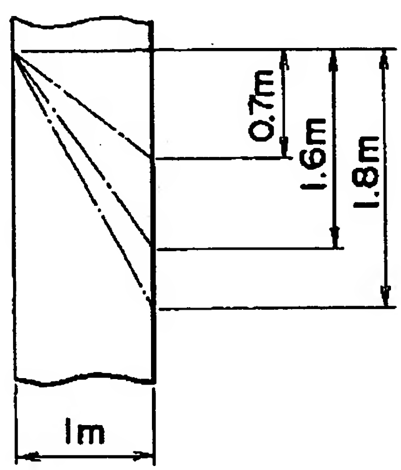


FIG. 4

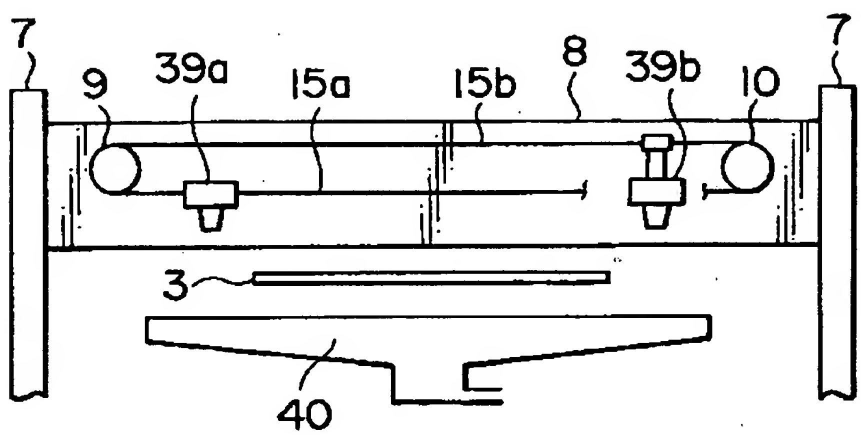


FIG. 5a

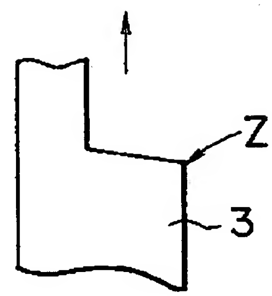


FIG. 5b

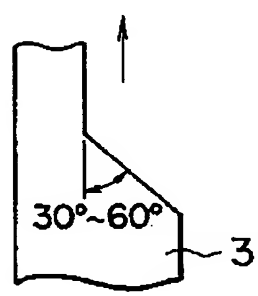


FIG. 6a

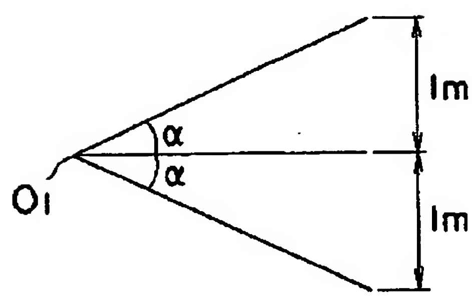


FIG. 6b

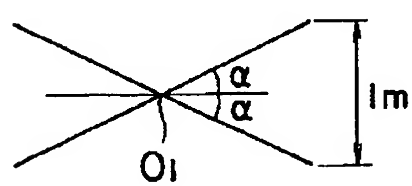


FIG. 7

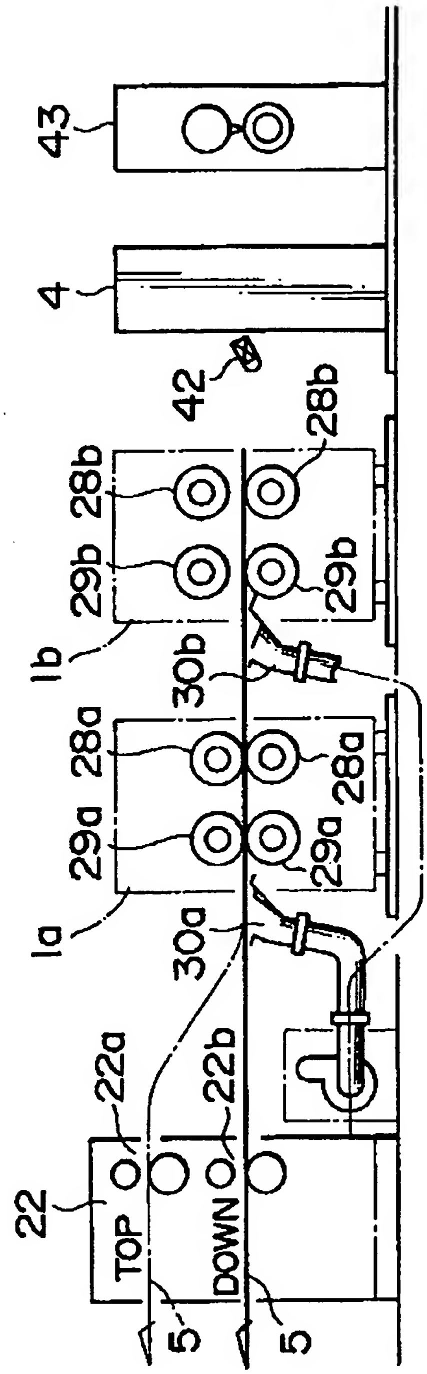

43
4
42
28b
29b
28b
29b
1b
30b
28a
29a
28a
29a
1a
30a
22a
22b
22
TOP
DOWN
5
5

FIG. 8

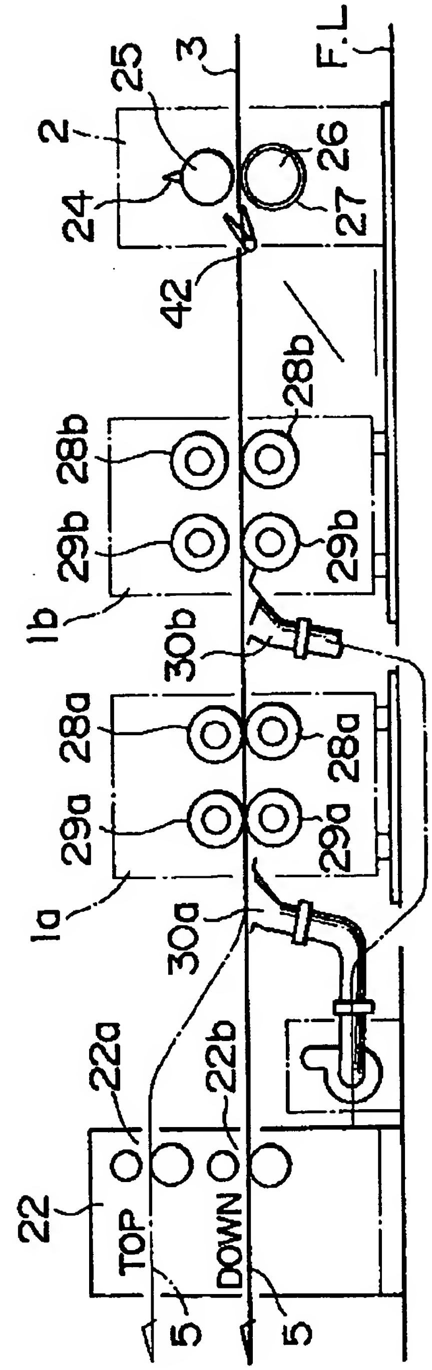

2
3
24
25
26
27
42
F.L
28b
29b
1b
30b
28a
29a
1a
30a
22a
22b
22
TOP
DOWN
5

FIG. 9

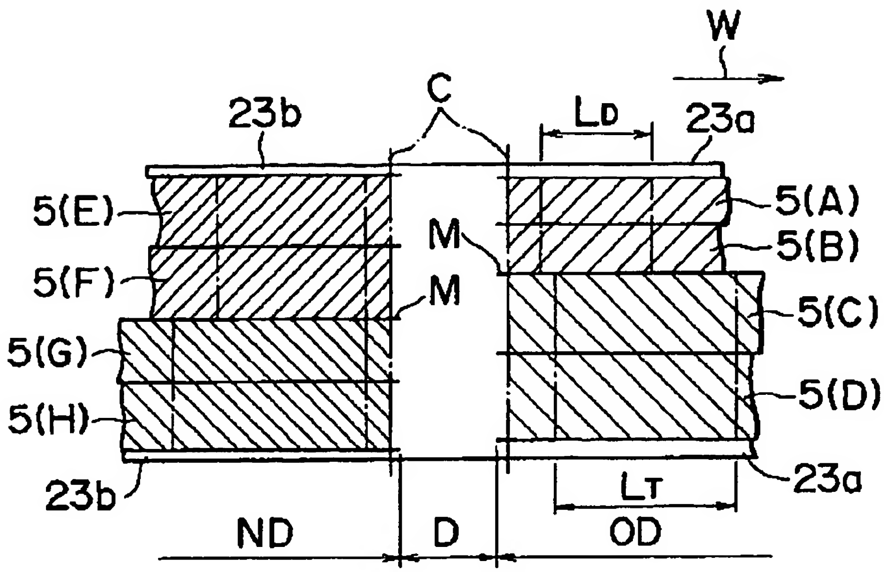


FIG. 10

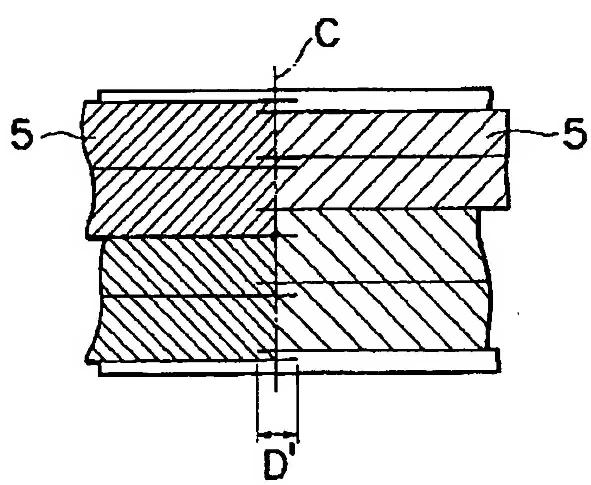


FIG. 11

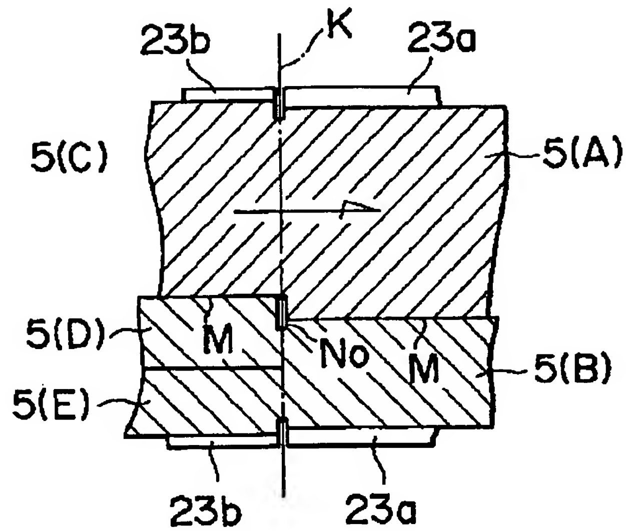

23b
K
23a
5(C)
5(A)
5(D)
M
No
M
5(B)
5(E)
23b
23a

FIG. 12

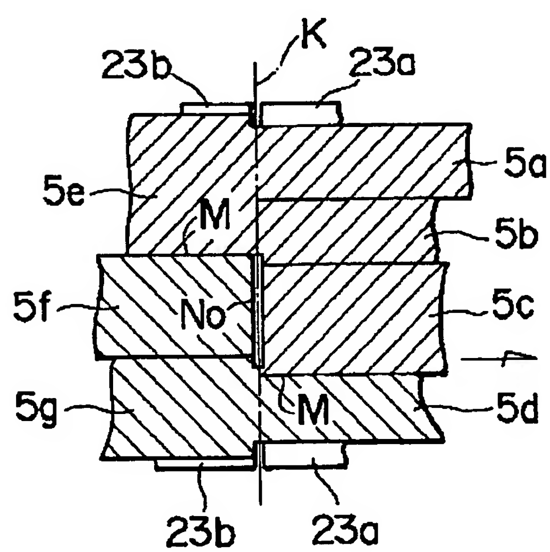

23b
K
23a
5a
5e
M
5b
5f
No
5c
5g
M
5d
23b
23a

FIG. 13

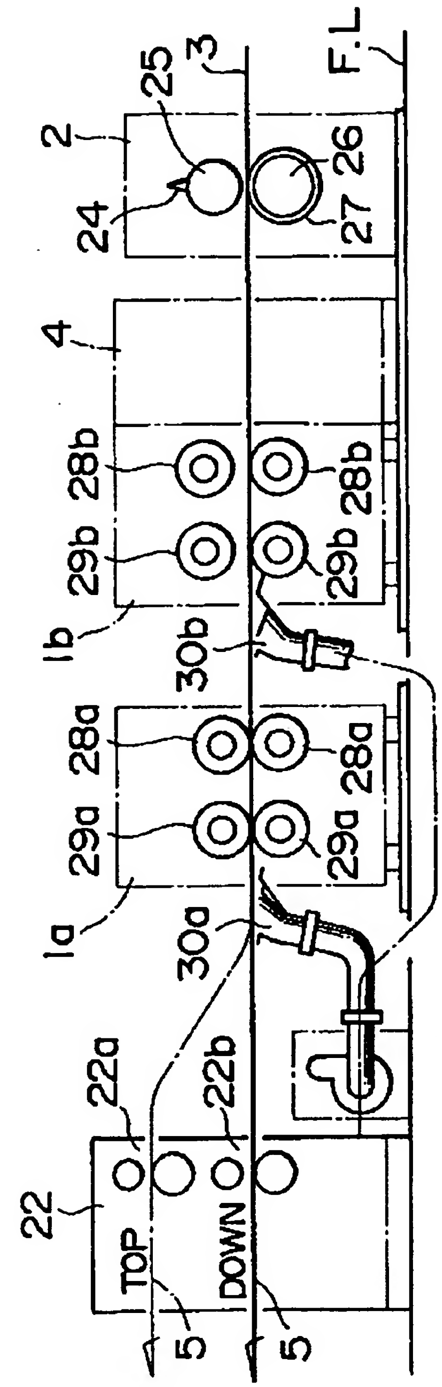

2
3
4
24
25
26
27
F.L
28b
29b
28b
29b
1b
30b
28a
29a
28a
29a
1a
30a
22
22a
22b
TOP
DOWN
5
5

FIG. 14

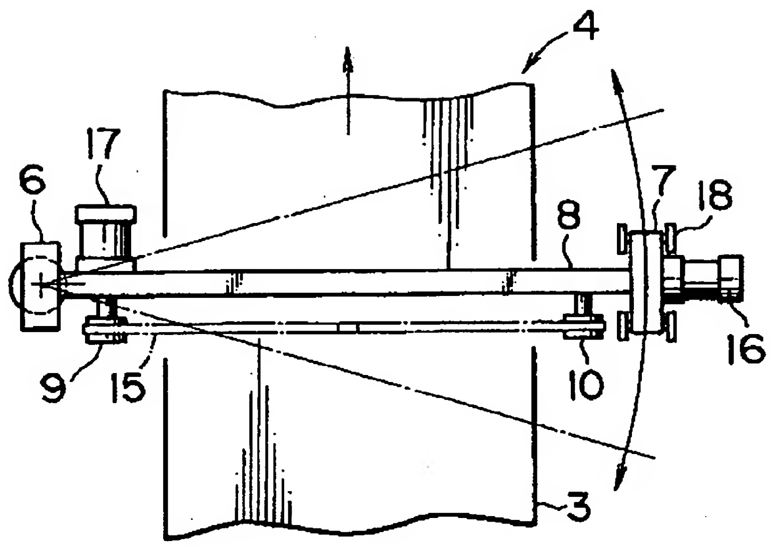


FIG. 15

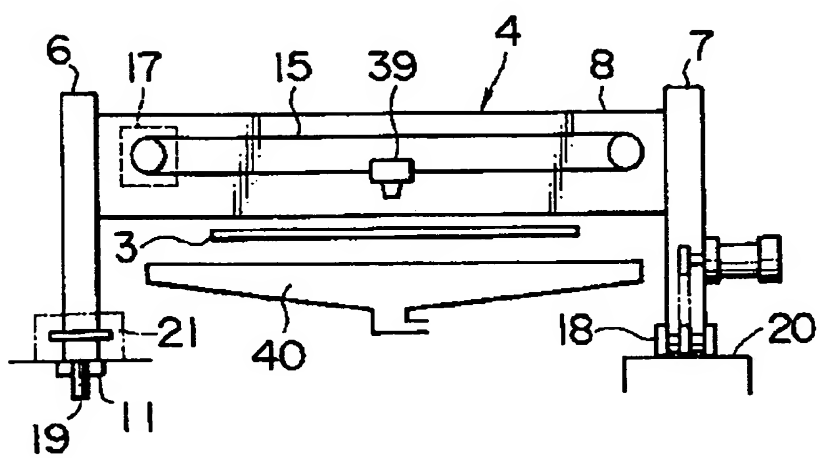


FIG. 16